WHAT IS CLAIMED IS:

1. An ink jet recording head comprising a flow passage formation substrate in which pressure generation chambers communicating with nozzle openings are defined and a piezoelectric element being placed on one side of said flow passage formation substrate via a diaphragm and having at least a lower electrode, a piezoelectric layer, and an upper electrode, comprising:

a compression film having a compressive stress and at least a part in a thickness direction removed in at least a part of an area opposed to the pressure generation chamber, thereby forming a removal part.

2. The ink jet recording head as claimed in claim 1 wherein the compression film is other than the piezoelectric layer.

3. The ink jet recording head as claimed in claim 1, wherein the compression film has at least a part in the thickness direction removed only in a portion along margins of the pressure generation chamber on both sides of said piezoelectric element in a width direction thereof.

4. The ink jet recording head as claimed in claim 1, wherein the compression film is a conductive film being placed between the lower electrode and the piezoelectric layer and made of a material substantially different from that of the lower electrode.

5. The ink jet recording head as claimed in claim 4, wherein the conductive film is a film containing a second conductive film formed on the lower electrode and a first conductive film formed on the second conductive film and at least the second conductive film is a film made of a material different from that of the lower electrode.

6. The ink jet recording head as claimed in claim 5 wherein the second conductive film is a film comprising either platinum or iridium.

7. The ink jet recording head as claimed in claim 5, wherein the second conductive film is a metal oxide film.

8. The ink jet recording head as claimed in claim 7, wherein the first conductive film is a film formed of a material for preventing lead contained in the piezoelectric layer from diffusing.

9. The ink jet recording head as claimed in claim 7, wherein the second conductive film comprises any of iridium oxide, rhenium oxide, or ruthenium oxide.

10. The ink jet recording head as claimed in claim 1, wherein the compression film forms at least a part of an elastic film forming at least a part of the diaphragm.

11. The ink jet recording head as claimed in claim 10 wherein at least the residue of the compression film forming a part of the elastic film is made of a polycrystalline substance.

12. The ink jet recording head as claimed in claim 11, wherein the elastic film is made of the compression film only.

13. The ink jet recording head as claimed in claim 11, wherein the elastic film is made of a film of multiple layers and at least the top layer is the compression film.

14. The ink jet recording head as claimed in claim 13, wherein the compression film forming the elastic film is made of metal oxide.

15. The ink jet recording head as claimed in claim 14 wherein the compression film is made of zirconium oxide or hafnium oxide and has a crystal structure of a monoclinic system.

16. The ink jet recording head as claimed in claim 13, wherein a layer below the compression film is a layer made of a material different from the compression film in etching characteristic and is not selectively etched.

17. The ink jet recording head as claimed in claim 16, wherein the not selectively etched layer below the compression film is selected from metal, stabilization or partial stabilization zirconium oxide, and stabilization or partial stabilization hafnium oxide.

18. The ink jet recording head as claimed in claim 10, wherein the lower electrode is made of a film having a tensile stress and is thinner than the compression film of the portion with at least a part removed.

19. The ink jet recording head as claimed in claim 13, wherein the elastic film contains a silicon dioxide film or a boron-doped silicon film on the pressure generation chamber side.

20. The ink jet recording head as claimed in claim 1, wherein the lower electrode is made of the compression film.

21. The ink jet recording head as claimed in claim 20 wherein the lower electrode is made of a metal material.

22. The ink jet recording head as claimed in claim 20 wherein the lower electrode is made of metal oxide.

23. The ink jet recording head as claimed in claim 20 wherein the lower electrode is made of metal nitride.

24. The ink jet recording head as claimed in claim 20, wherein the lower electrode on both sides of the piezoelectric layer in a width direction thereof is completely removed.

25. The ink jet recording head as claimed in claim 1, wherein the upper electrode is formed of the compression film and is patterned together with the piezoelectric layer.

26. The ink jet recording head as claimed in claim 25 wherein the upper electrode made of the compression film has a compressive stress at least after said piezoelectric element is patterned.

27. The ink jet recording head as claimed in claim 26 wherein the upper electrode comprises a metal material.

28. The ink jet recording head as claimed in claim 27 wherein the upper electrode made of the compression film is formed by a sputtering method and a predetermined gas is added into the metal material, whereby the upper electrode becomes a compressive stress.

29. The ink jet recording head as claimed in claim 28 wherein the predetermined gas is an inert gas selected from helium, neon, argon, krypton, xenon, and radon.

30. The ink jet recording head as claimed in claim 27 wherein at least one additive selected from metal, semimetal, semiconductor, and insulator different in constituent is added into the metal material, whereby the upper electrode made of the compression film becomes a compressive stress.

31. The ink jet recording head as claimed in claim 30 wherein the additive is added to the upper electrode by executing ion implantation.

32. The ink jet recording head as claimed in claim 30 wherein the additive is added to the upper electrode by executing solid-phase diffusion from a layer placed on the upper electrode.

33. The ink jet recording head as claimed in claim 32 wherein the solid-phase diffusion is executed by heating in an insert gas or in vacuum.

34. The ink jet recording head as claimed in claim 25, wherein the upper electrode has a first electrode formed on a surface of the piezoelectric layer and a second electrode deposited on the first electrode and the second electrode is a film made of metal oxide or metal nitride.

35. The ink jet recording head as claimed in claim 34 wherein the first electrode comprises a metal material.

36. The ink jet recording head as claimed in claim 21, wherein the metal material is selected from platinum, palladium, iridium, rhodium, osmium, ruthenium, and rhenium, and compounds thereof.

37. The ink jet recording head as claimed in claim 14, wherein the metal oxide is selected from ruthenium oxide, indium oxide tin, cadmium indium oxide, tin oxide, manganese oxide, rhenium oxide, iridium oxide, strontium ruthenium oxide, indium oxide, zinc oxide, titanium oxide, zirconium oxide, tantalum oxide, hafnium oxide, osmium oxide, rhodium oxide, palladium oxide, and molybdenum oxide, and compounds thereof.

38. The ink jet recording head as claimed in claim 23, wherein the metal nitride is selected from titanium nitride, niobium nitride, zirconium nitride, tungsten nitride, hafnium nitride, molybdenum nitride, tantalum nitride, chromium nitride, and palladium nitride, and compounds thereof.

39. The ink jet recording head as claimed in claim 37, wherein layers formed of the metal oxide and the metal nitride are formed by oxidation or nitriding after film formation.

40. The ink jet recording head as claimed in claim 1, wherein the elastic film forming at least a part of the diaphragm has at least a part in a thickness direction removed in an area which is opposed to the pressure generation chamber and is other than the piezoelectric layer.

41. The ink jet recording head as claimed in claim 40 wherein the elastic film has at least a part in the thickness direction removed only in a portion along the margins of the pressure generation chamber on both sides of said piezoelectric element in the width direction thereof.

42. The ink jet recording head as claimed in claim 40, wherein said piezoelectric element is formed on the elastic film so as to extend to the portion with at least a part of the elastic film removed.

43. The ink jet recording head as claimed in claim 42 wherein the piezoelectric layer forming said piezoelectric element is roughly uniformly thick.

44. The ink jet recording head as claimed in claim 42 wherein an end of the extension of the piezoelectric layer forming said piezoelectric element to the portion with the part of the elastic film removed is thicker than other portions.

45. The ink jet recording head as claimed in claim 40, wherein at least a part of the piezoelectric layer is formed across an area opposed to the pressure generation chamber and said piezoelectric element is formed by patterning only the upper electrode or the upper electrode and a part of the piezoelectric layer in a thickness direction thereof.

46. The ink jet recording head as claimed in claim 40, wherein the lower electrode is placed uniformly in an area opposed to said piezoelectric element and in other areas.

47. The ink jet recording head as claimed in claim 1, wherein the diaphragm is deformed convex outwardly from the pressure generation chamber.

48. The ink jet recording head as claimed in claim 1, wherein a stress of the piezoelectric layer when a drive force load is imposed on said piezoelectric element is equal to a stress at the piezoelectric layer formation time or is larger in a tension direction.

49. The ink jet recording head as claimed in claim 48 wherein said piezoelectric element in the area opposed to the pressure generation chamber is bent convex to the piezoelectric layer side when the pressure generation chamber is formed.

50. The ink jet recording head as claimed in claim 48, wherein an expansion force of a portion of the diaphragm opposed to said piezoelectric element in the area opposed to the pressure generation chamber is relatively smaller to the compression side than an expansion force in other than the area opposed to said piezoelectric element.

51. The ink jet recording head as claimed in any one of claims 1 to 50 wherein the pressure generation chambers are formed on a silicon monocrystalline substrate by anisotropic etching and the layers of said piezoelectric element are formed by film forming and lithography process.

52. An ink jet recorder comprising an ink jet recording head as claimed in any one of claims 1 to 50.

53. The ink jet recording head as claimed in claim 1, wherein said compression film is an elastic film and said lower electrode film is formed uniformly on said elastic film without patterning.

54. The ink jet recording head as claimed in claim 1, wherein ends of said piezoelectric element are extended to an area opposite to said removal part.

55. The ink jet recording head as claimed in claim 1, wherein said first electrode is said compression film.

56. A method of making an ink jet recording head having a flow passage formation substrate comprising the steps of:

forming an elastic film having a compressive stress on said flow passage formation substrate;

forming a first electrode film on said elastic film;

forming a piezoelectric film on said electrode film;

forming a second electrode film on said piezoelectric film;

etching said second electrode film, said piezoelectric film, and said first electrode film to form a piezoelectric part; and

overetching said elastic film in the thickness direction to form elastic film removal parts.

57. The method of claim 56, wherein said piezoelectric film, said first electrode film, and said second electrode film are under tension before said etching step.

58. The method of claim 57, wherein said etching step and said overetching step are performed so that tensile stresses released during said etching step balance with a compressive stress released during said overetching step.

59. The method of claim 58, wherein said elastic film comprises at least 2 layers.

60. A method of making an ink jet recording head having a flow passage formation substrate and pressure generating chambers formed therein comprising the steps of:

forming a compressive film having a compressive stress on said flow passage formation substrate;

overetching said compressive film in the thickness direction to form elastic film removal parts;

forming a lower electrode film on said overetched compressive film;

forming a piezoelectric active part on said lower electrode film.

61. The method of claim 60, wherein said piezoelectric active part includes a piezoelectric film formed over substantially all of said flow passage formation substrate and an upper electrode film formed on said piezoelctric film.

62. The method of claim 56, further including the steps of:

extending said piezoelectric active part in the width direction to an area opposed to said elastic film removal part.

63. A method of making an ink jet recording head having a flow passage formation substrate comprising the steps of:

forming an compressive film having a compressive stress on said flow passage formation substrate;

forming a piezoelectric part; and

overetching said compressive film in the thickness direction to form elastic film removal parts.

64. The ink jet recording head as claimed in claim 4, wherein said conductive film is a metal oxide film.

65. The ink jet recording head as claimed in claim 4, wherein said conductive film is a film formed of a material for preventing lead contained in the piezoelectric layer from diffusing.

66. The ink jet recording head as claimed in claim 65, wherein said material for preventing lead contained in the piezoelectric layer from diffusing is selected from iridium, iridium oxide, ruthenium oxide and rhenium oxide.